UNIVERSITI PUTRA MALAYSIA

CROSSBREEDING OF THREE IRANIAN SHEEP BREEDS WITH RESPECT TO REPRODUCTIVE, GROWTH AND CARCASS CHARACTERISTICS

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By

MOHAMMAD REZA KIYANZAD

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirement for the Degree of Doctor of Philosophy

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Dedication

To my parents, my dear wife and my children for their moral supports and encouragement.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

CROSSBREEDING OF THREE IRANIAN SHEEP BREEDS WITH RESPECT TO REPRODUCTIVE, GROWTH AND CARCASS CHARACTERISTICS

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February 2002

Chairman: **Dr. Jothi Malar Panandam**

Faculty: **Agriculture**

In Iran, increasing demand for red meat, caused by increasing human population, pasture limitations and increasing cost of production, has become an impetus for sheep producers to change the system of farming and optimise meat production for more efficient output per unit livestock. One way to achieve the latter goal is by taking advantage of the effect of heterosis from crossbreeding.

Twenty seven rams and 473 ewes of three popular breeds of sheep in Iran, namely the Chal, Moghani and Zel, were crossed reciprocally. The reproductive performances of the ewes, and the growth performance, feed conversion ratio and carcass traits of the offspring, under an intensive system of management, were studied.

Zel ewes showed higher ($P<0.05$) overall apparent fertility, reproductivity and productivity compared Chal and Moghani ewes. However, when the problem

encountered by Zel rams in impregnating the bigger and fat-tailed breeds was taken into consideration, the breeds did not differ in ewe productivity and reproductivity. Zel ewes had relatively high pre-weaning lamb mortality, reducing their ewe efficiency.

Zel lambs had lower body weights and growth rates than Chal and Moghani. Their carcass had significantly ($P<0.05$) lower total dissectible fat and more lean meat and bone percentages. Lambs sired by Chal and Moghani were heavier than those sired by Zel. Feed conversion ratio was not affect by crossbreeding. Chal, Moghani and Chal-Moghani crossbreeds showed lower prime-cut ($P<0.05$) and higher fat-tail percent than the other breed groups. ZC (Zel ♂ x Chal ♀) had lower ($P<0.05$) weaning and finishing weights than CC (Chal ♂ x Chal ♀). Their carcass fat percentages did not show significant difference. ZM (Zel ♂ x Moghani ♀) had significantly ($P<0.05$) lower birth, weaning and finishing weights than MM (Moghani ♂ x Moghani ♀). MM, however, had higher carcass percent, but lower lean meat percent.

Zel ewes mated by Chal rams showed 26% higher ($P<0.05$) ewe efficiency than those mated by Zel. CZ (Chal ♂ x Zel ♀) had heavier weaning and finishing weights and more fat percentage in fat-tail but less intramuscular and subcutaneous fat percentages compared to ZZ (Zel ♂ x Zel ♀). Carcass lean meat and fat percentages were similar. Zel ewes mated to Moghani rams weaned 28.5% more kilograms of lambs than those mated to Zel rams. Weaning and finishing weights of

MZ (Moghani ♂ x Zel ♀) were heavier than ZZ, but they had higher carcass fat percentages.

The males were, generally, heavier ($P<0.05$) than females from birth to finishing. Twins did not differ from singles for finishing weight. Females showed significantly ($P<0.05$) higher prime-cut and lower fat-tail percentages. Lean meat, fat and bone percents were not affected by sex or litter size.

It may be concluded that it would be beneficial to cross Chal rams with Zel ewes to produce CZ commercial lambs. However, to increase the ewe efficiency and to reduce their pre-weaning lamb mortality, supplemented feeding during pre-weaning period should be practised. Lambs of both sexes may be used in the feedlot.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagi memenuhi kepeluan untuk ijazah Doctor of Falsafah

PEMBIAKBAKAAN KACUK TIGA BAKA BEBIRI IRAN MERUJUK KEPADA CIRI PEMBIAKAN, TUMBESARAN DAN KARKAS

Oleh

MOHAMMAD REZA KIYANZAD

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Di Iran, peningkatan permintaan untuk daging merah, disebabkan pertambahan populasi manusia, limitasi pastura dan peningkatan kos pengeluaran, telah menjadi satu pencetus kepada penternak-penternak bebiri untuk menukar sistem perladangan dan mengoptimasikan pengeluaran daging dengan pengeluaran yang lebih efisien daripada setiap unit ternakan. Salahsatu jalan untuk mencapai matlamat yang kedua ialah dengan menggunakan kesan heterosis hasil pembiakbakaan kacuk.

Dua puluh tujuh bebiri jantan dan 473 bebiri betina daripada tiga baka yang popular di Iran, iaitu Chal, Moghani dan Zel, telah dikacukkan secara silang. Prestasi pembiakan bebiri betina, dan prestasi tumbesaran, kadar penukaran makanan dan ciri-ciri karkas anak bebiri, di bawah sistem pengurusan intensif, telah dikaji.

Bebiri betina Zel telah menunjukkan kesuburan tampak keseluruhan, reproduktiviti dan produktiviti yang lebih tinggi ($P<0.05$) berbanding dengan bebiri betina Chal dan Moghani. Walau bagaimanapun, apabila masalah yang dihadapi oleh

bebiri jantan Zel membuntingkan baka yang lebih besar dan dengan ekor-lemak diambilkira, baka-baka tersebut tidak berbeza bagi produktiviti daan reproduksi betina. Bebiri betina Zel mempunyai mortiliti anak bagi tempoh pra-sapih yang tinggi secara relatif , mengurangkan kecekapan mereka.

Anak bebiri Zel mempunyai berat badan dan kadar tumbesaran yang lebih rendah daripada Chal dan Moghani. Karkas mereka mengandungi lemak yang boleh diasingkan yang lebih rendah secara bererti ($P<0.05$) dan peratus daging lembut dan tulang yang lebih. Anak bebiri dengan Chal atau Moghani sebagai induk jantan adalah lebih berat daripada yang mempunyai Zel sebagai induk jantan. Kadar penukaran makanan tidak dipengaruhi pembiakbakaan kacuk. Chal, Moghani dan kacukan Chal-Moghani menunjukkan potongan prima yang lebih rendah ($P<0.05$) dan peratus lemak ekor yang lebih tinggi daripada kumpulan anak bebiri yang lain. ZC (Zel ♂ x Chal ♀) mempunyai berat sapih dan berat akhir yang lebih kurang ($P<0.005$) daripada CC (Chal ♂ x Chal ♀). Peratus lemak karkas mereka tidak berbeza secara bererti. ZM (Zel ♂ x Moghani ♀) mempunyai berat lahir, berat sapih dan berat akhir yang lebih rendah daripada MM (Moghani ♂ x Moghani ♀). MM mempunyai peratus karkas yang lebih tinggi, tetapi peratus daging lembut yang lebih rendah.

Zel betina yang dikawankan dengan jantan Chal menunjukkan kecekapan betina yang 26% lebih tinggi ($P<0.005$) daripada yang dikawankan dengan jantan Zel. CZ (Chal ♂ x Zel ♀) mempunyai berat sapih, berat akhir dan peratus lemak pada ekor-lemak yang lebih tinggi tetapi kurang peratus lemak intramaskular dan

subkutanos berbanding dengan ZZ (Zel ♂ x Zel ♀). Peratus daging lembut dan lemak adalah serupa. Bebiri betina Zel yang dikawankan dengan jantan Moghani menyisapihkan 28.5% lebih kilogram anak berbanding dengan yang dikawankan dengan jantan Zel. Berat sapih dan berat akhir MZ (Moghani ♂ x Zel ♀) lebih berat daripada ZZ, tetapi mereka mempunyai peratus lemak pada karkas yang lebih tinggi.

Jantan, secara umumnya, adalah lebih berat ($P<0.05$) daripada betina sejak lahir hinggalah berat akhirnya. Anak kembar tidak berbeza ($P<0.05$) daripada anak tunggal untuk berat akhir. Betina menunjukkan potongan prima yang tinggi dan peratus lemak ekor yang rendah secara bererti. Peratus daging lembut, lemak dan tulang adalah tidak dipengaruhi oleh jantina atau saiz perindukan.

Bolehlah disimpulkan bahawa kacukan antara bebiri jantan Chal dan betina Zel untuk menghasilkan anak bebiri komersial CZ akan membawa manfaat. Walau bagaimanapun, untuk meningkatkan kecekapan betina Zel dan mengurangkan kematian anak bebiri pada tempoh pra-sapih, pemberian makanan tambahan semasa tempoh pra-sapih patut diamalkan. Anak bebiri kedua-dua jantina boleh digunakan dalam fidlot.

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I certify that Examination Committee met on 28th February 2002 to conduct the final examination of Mohammad Reza Kiyanzad
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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.

MOHAMMAD REZA KIYANZAD

Date: 11.03.2002

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

A	Maximum width of the longissimus muscle at cross-section posterior to the last rib
B	Maximum depth of the longissimus muscle at cross-section posterior to the last rib
BL1	Body length at birth
BL2	Body length at weaning
BL3	Body length at finishing
BW	Birth weight
C	Chal
C_1	Subcutaneous fat thickness over the point of greatest depth of the longissimus muscle posterior to the last rib
Ca	calcium
CC	Chal $_{(♂)}$ x Chal $_{(♀)}$
CCW	Cold carcass weight
CF	Chemical fat
CM	Chal $_{(♂)}$ x Moghani $_{(♀)}$
C-M	Reciprocal crosses of Chal and Moghani breeds
CZ	Chal $_{(♂)}$ x Zel $_{(♀)}$
C-Z	Reciprocal crosses of Chal and Zel breeds
DE	Digestible energy
df	degree of freedom
DM	dry matter
EBW	Empty body weight

EE	Ewe efficiency
EE_{MWE}	Ewe efficiency based on metabolic weight of ewe exposed
EE_{MWL}	Ewe efficiency based on metabolic weight of lambed ewes
F_1	first filial generation
FADG	Feedlot average daily gain
FCR	Feed conversion ratio
FW	Finishing weight
GR	True depth of soft tissue over 12^{th} rib, 11 cm from the dorsal midline on intact cold carcass.
HCW	Hot carcass weight
HG1	Heart girth at birth
HG2	Heart girth at weaning
HG3	Heart girth at Finishing
HW1	Height at wither at birth
HW2	Height at wither at weaning
HW3	Height at wither at finishing
M	Moghani
MC	Moghani (♂) x Chal (♀)
ME	Metabolizable energy
MM	Moghani (♂) x Moghani (♀)
MS	mean square
MZ	Moghani (♂) x Zel (♀)
M-Z	Reciprocal crosses of Moghani and Zel breeds
NFE	Nitrogen free extract

NGR	Measurements of GR with a 22-gauge hypodermic needle over the 12^{th} rib, 12-cm from the dorsal midline.
P	phosphorus
PADG	Pre-weaning average daily gain
SS	sum of square
SW	Slaughter weight
UGR	Ultrasonic Measurements of GR
WW	Weaning weight
Z	Zel
ZC	Zel (♂) x Chal (♀)
ZM	Zel (♂) x Moghani (♀)
ZZ	Zel (♂) x Zel (♀)

CHAPTER 1

INTRODUCTION

In Iran, red meat is one of the common sources of protein. The average red meat consumption per capita is 14 kg (Kiyanzad and Monem, 1999). The main sources of red meat are cattle, buffalo, sheep and goat. Meat from these sources, however, is not sufficient to meet the demand.

Sheep population in Iran is 50 million, comprising of 26 genetic groups. Meat production by sheep and goat amounts to 57% of the total red meat production in the country (FAO, 1998; Osfoori and Fesus, 1996). Sheep are kept for meat, wool, milk and pelt. Although there has been an increase in production over the years, the country aims only not for self-sufficiency, but also to be able to export mutton (Kiyanzad and Monem, 1999; FAO, 1997; Yalcin, 1979).

Periodical drought, overgrazing, lack of management of pasture, use of pasture plants by clans and villagers as fuel and use of pasture area for crop cultivation over the last four decades has caused the pasture capacity to be reduced. On the other hand, increasing demand for red meat, limitation faced by animal food producers (land use for other purposes, climatic conditions, etc.) and increasing cost of production, has become an impetus for livestock producers to change the system of production. The traditional sheep keeping practices are no longer viable or economical. It has become a necessity to adopt the intensive or semi-intensive system of farming and to use more productive animals or breeds so that sheep